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Evaluation of Accident Records and Blackspot Detection on National Highway 205, Punjab, Between S.A.S. Nagar to Rupnagar.

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Abstract:
India's roads are the most affordable mode of transportation, but they are also susceptible to accidents, posing risks to drivers' lives and property. To reduce traffic accidents, it's crucial to identify accident blackspots and implement remedial measures. Financial constraints may prevent immediate countermeasures, so ranking blackspots and implementing them is essential. The paper contains an extensive analysis of road accident statistics for the 44.6-kilometer stretch of National Highway 205 in Punjab, India, that runs between S.A.S. Nagar and Rupnagar. Accident blackspots have been observed in both directions along the highway element, based on an analysis of accident data obtained from the Institute For Development and Communication (IDC) Chandighar (U.T.), Punjab from 2017 to 2020. Four distinct defined standards have been used to rate the locations of the observed blackspots. The top ten blackspot locations have been thoroughly investigated and analysed to identify potential causes of accidents. Based on the findings, alternatives to reduce road accidents have been proposed.

Key Words: NH-205, Blackspots, Road Accidents, Vehicle.

Introduction

National Highway 205, a vital transportation route connecting S.A.S. Nagar and Rupnagar in Punjab, has been plagued by incidents, raising concerns about road safety. To improve safety, the research aims to understand the causes of these incidents and identify blackspots with high accident frequency. The study will assess accident reports, examine relevant variables, and employ advanced blackspot identification methods. Roads provide assistance to the world's transport network. Over 60% of India's commodities and 85% of its population travel by road, making it the most economical mode of transportation for both people and things. Of all the means of transportation, driving has the highest danger of both serious injury and fatalities from accidents, as well as the highest likelihood of damaging autos.

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With significant investment by the government in infrastructure, road accidents are still on the rise in India, with over 460,000 accidents in 2022 accounting for an all-time high of 168,491 fatalities.

As to the annual report on road accidents issued by the Ministry of Road Transport and Highways on Tuesday, there were 461,312 events recorded by the states and Union Territories (UTs) in 2022, resulting in 443,366 injuries. Compared to 2021, the year had a rise of 11.9% in accidents, 9.4% in deaths, and 15.3% in injuries. India's road network, which consists of National Highways (NH), Motorways, State Highways (SH), Major District Roads, Other District Roads, and Village Roads, is the second biggest in the world, according to the Ministry of Road Transport and Highways (2022). Its total length is around 63.72 km.

Table:1 Year Wise NH Development Length in KM.

Sr. No.	Year	Length of NH in KM
1	At 2013	91287
2	2014	97830
3	2015	101010
4	2016	114158
5	2017	126500
6	2018	132500
7	2019	132995
8	2020	138376
9	2021	141345
10	2022	145240
11	2023	146145

Table:2 India's Road Length (In Km) Divided Into Several Categories.

Category	2010-11	2021-22	2022-2023
National Highway	70,548 km	142,126 km	146,145 Km
State Highways	152,024 km	176,166 km	179,535 Km
Major District Roads	474,464 km	534,996 km	632,154 Km
Rural and Other Roads	4,700,000 km	3,300,000 km	4,535,511 Km
Total length of Road	5,397,036 km	4,153,288 km	5493345 Km

India's Road Accident Record

The Ministry of Road Transport and Highways (MoRTH) released official figures showing that 153,972 people lost their lives in traffic accidents in 2021. This translates to 11.3 fatalities per 100,000 people. In 2020, there were 243.5 million registered motorised two-wheelers (MTW) and 43.73 million vehicles. The number of cars in real operation is overrepresented in official registration statistics because vehicles that are retired from the road for various reasons, such as age, are not expunged from the records. Between 50 and 60 percent of the automobiles listed

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in the registration documents are thought to be personal vehicles on the road. The Road Accidents in India-2020 report goes on to show that, in 2020, National Highways—which make up just 2% of all of India's roads—accounted for 32% of all road accidents and roughly 36% of all accidental deaths. State Highways, on the other hand, only make up 3% of all road networks, but they accounted for 25% of all accidents and accidental deaths in the same year. These statistics demonstrate that, as the country's primary causes of road user mortality, both National Highways and State Highways require policymakers' attention.

Table:3 Road Accidents during (2012-2022)

Year	No. of Road Accidents	No. of Affected Person	
		Killed	Injured
2012	4,90,383	1,38,258	5,09,667
2013	4,86,476	1,37,572	4,94,893
2014	4,89,400	1,39,671	4,93,474
2015	5,05,770	1,46,555	5,03,608
2016	4,84,756	1,51,192	4,97,806
2017	4,69,242	1,50,003	4,67,389
2018	4,70,403	1,57,593	4,64,715
2019	4,56,959	1,58,984	4,49,360
2020	3,72,181	1,38,383	3,46,747
2021	4,12,432	1,53,972	3,84,448
2022	4,61,312	1,68,491	4,43,366

On national highways, there were 30.6% of all accidents and 35.7% of deaths in 2019; in 2020, those numbers increased to 31.8% and 36.4%, respectively. In 2020, 24.8 per cent of all accidents will occur on state highways, as opposed to 24.2 per cent during the same period in 2019. On the other hand, the percentage of accidents on other roads decreased from 45.2% in 2019 to 43.4% in 2020 during the same period. National highways make up just 2.08 per cent of all roads in the country, yet they will be responsible for 36.4% of all deaths in 2020; other roads will account for 38.4%, and state highways for 25.2%.

Blackspots for Road Accidents

Highway sites known as blackspots are particular places where serious and frequent accidents happen. These locations, which show places with a higher-than-average rate of events, are found through data analysis of traffic accidents. Enhancing road safety and lowering the incidence of accidents requires locating and fixing these blackspots. Black spots are areas with a high crash rate that are recognised by websites that have an unusually high crash rate in relation to similar websites. In the management of road safety, a region where there has historically been a high concentration of traffic accidents is called an accident black spot. Black spots are generally used to characterise areas with a high accident rate and a high probability of future occurrences (severe, large, and minor).

Study Site

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This study is being carried out over the National Highways-205 in the state of Punjab (Fig. 2). Within the parameters of the study, only toll-road National Highways have been taken into consideration. This study provides specifics on the NH-205 road accident scenario that passes through the Punjabi districts of S.A.S. Nagar and Rupnagar. The NH-205, which spans 65 km (13.40-80.80) and is located in the state of Punjab under PIU Chandigarh, is the subject of this research. It begins at kilometre 28+600 and ends at km 73+200.

Table 4: Description of the NH-205 Toll Plaza.

Location of Toll Plaza	Number of Lanes	Starting Chainage	End Chainage	Length of Toll Plaza Zone
At Km 35+000 on NH-205 in Behrampur (Punjab)	10 Lanes	Km 34+775	KM 35+275	500m

Fig.1: Behrampur Toll Plaza.

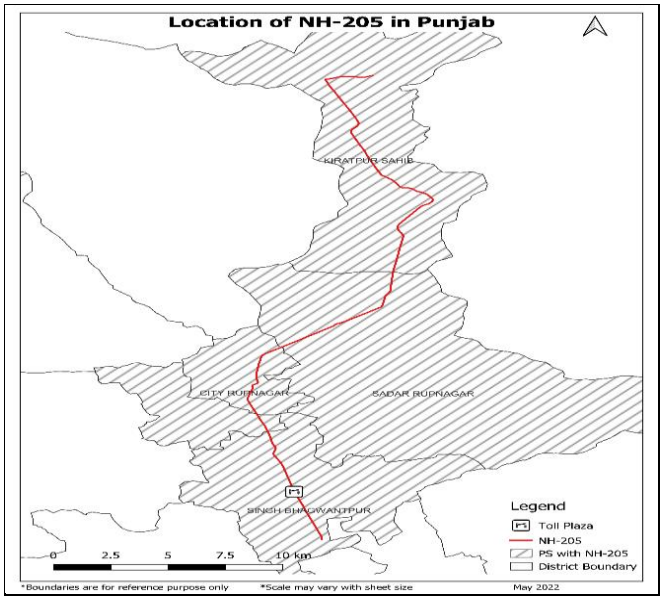

Fig. 2: Study site of NH-205 Sagment in Punjab.

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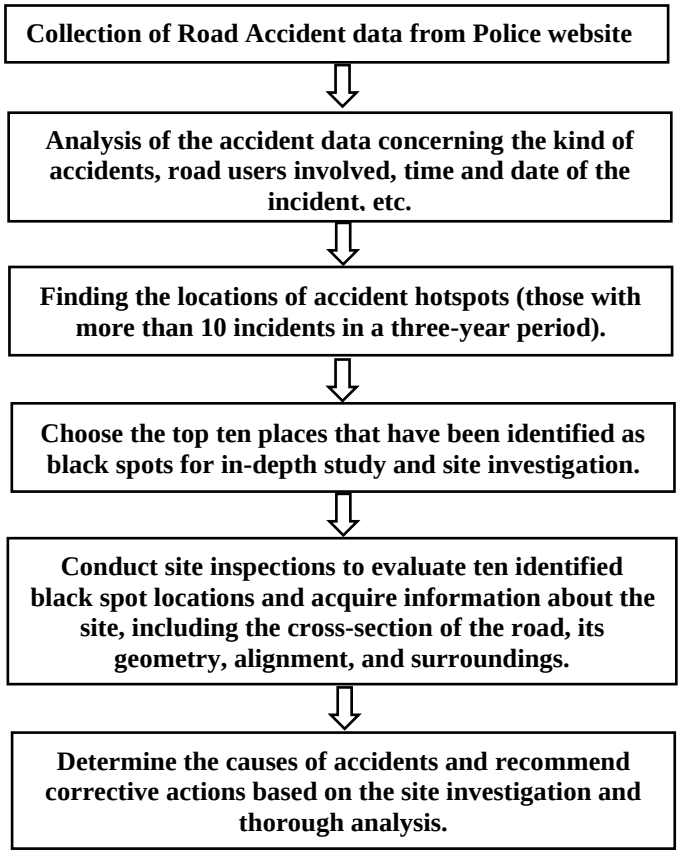
Approaches Used in the Investigation

The Institute For Development and Communication (IDC) Chandighar (U.T.), Government of India, defines a blackspot as any location or road section of that experiences 10 or more accidents or 10 or more fatalities during the three-year period between 2017 and 2020. This definition was used in the current study to identify the accident blackspots on the 44.6 km stretch of NH-205. The Haryana, Punjab and Chandighar Police website provided historical accident data, which was then analysed with respect to the date, time, and month of the incidents, the location of the incidents, the number of fatalities, the number of injured and deceased (with serious and minor injuries), the vehicles and other road users involved, and the nature of the collisions. Index maps have been used to identify or estimate the sites of the accidents and the separations between various places of NH-205.

Flow Chart-1 shows a schematic apporaches of the research approach that was used.



Road collision risk factors: a method based on data

Over several decades, there has been a notable rise in road traffic accidents in numerous developing countries worldwide, resulting in a substantial rise in the number of deaths. Such catastrophic events almost always cause a large reduction in a country's gross domestic product in addition to psychological distress for the victims' relatives. Therefore, it becomes essential to identify the risk factors and implement corrective measures to reduce traffic accidents. Still,

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the limited amount of research that has focused on roads with mixed traffic so far fails to adequately characterise the consequences of those features. Thus, the objective of the study was to provide a data-driven approach to determining the reasons behind traffic accidents and their consequences, especially where there is mixed traffic.

Effects of illnesses and categories of shoulders

Road cross-sectional elements such as shoulder width and carriageway have a significant influence on driving behaviour. The width of the carriageway is defined by the number of lanes, and the size of the vehicles and the required lateral clearance determine the width of each lane. The current rules recommend a minimum lane width of 3.5 metres, assuming a vehicle width of 2.44 metres and side clearances of approximately 0.53 metres on either side. On rural roads, provide more pavement for cars. This will accommodate driver error and give space for an emergency stop. Consequently, driving performance and the chance of a traffic collision are impacted by the shoulder's breadth and quality.

Given this, the present study attempted to understand how shoulder conditions influenced traffic conditions in mixed-traffic situations. Using site-specific data from twelve research locations, the analysis identified different shoulder conditions that led to traffic accidents. Study locations were ranked as excellent, good, medium, and bad based on shoulder conditions.

Fig.3: Blackspot Location Near Saini Services Station, Bannmajra Cut.

Fig.4: Blackspot Location of Near PNB Bank, Heritage Haveli, Solkhian.

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Effects of pavement quality:

The condition of the pavement is crucial for guaranteeing ride quality and passenger safety. Numerous studies have shown that it has a major impact on road traffic safety, and prompt pavement maintenance is thought to be an essential first step in improving road safety. However, the consequences of poor pavement conditions on on-road collisions have not been thoroughly studied in the few studies that have looked at the relationship between crash occurrences and pavement conditions to date. Although it is unclear how poorly maintained pavement contributes to traffic collisions, researchers advise having generally quality pavement to ensure a safer road environment for users.

Fig.5: Blackspot Location T-Point Malikpur.

Impact of Entry and Exit Points:

When there is direct access to nearby residences, particularly when there is not enough sight distance at such mid-block access points, highways become dangerous. Excessive access point density has been shown in several studies to dramatically increase the likelihood of accidents. The risk is exacerbated by mixed traffic, which consists of a range of vehicle types. An exaggeration of collision risks was recently discovered in a case study on the evaluation of crash risks at highway entry points, where mixed traffic is common and sight visibility is restricted due to the presence of vending enterprises. For many years, there has been much study on the link between access point density and crash occurrence; however, the exact pattern of this relationship is less clear.

Fig. 6: Blackspot Location Of Sales Tax Barrier, Ghanauli.

Assessment of Current Accidental Black Spot:

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Generally, Accident Severity Index (A.S.I.) is generated to identify the dangerous spots on the project corridor.

$$\mathbf{ASI} = (\mathbf{Nf} \times \mathbf{Wf}) + (\mathbf{Ng} \times \mathbf{Wg}) + (\mathbf{Nm} \times \mathbf{Wm})$$

Whereas

Nf = No. of Fatal Accidents at the Spot in the last 3 years
Wf = Weightage assigned to fatal accident is 6
Ng = No. of grievous injury accidents at the Spot in the last 3 years
Wg = Weightage assigned to grievous accident is 3
Nm = No. of minor injury accidents at the Spot in the last 3 years
Wm = Weightage assigned to minor accidents is 1

Table 5: Total Road Accidents On NH-205 Study Area.

Year	Cases	Fatal	Serious	Minor
2017	52	42	17	8
2018	54	41	21	21
2019	39	26	29	7
2020	40	24	18	9
Total	**185**	**133**	**85**	**45**

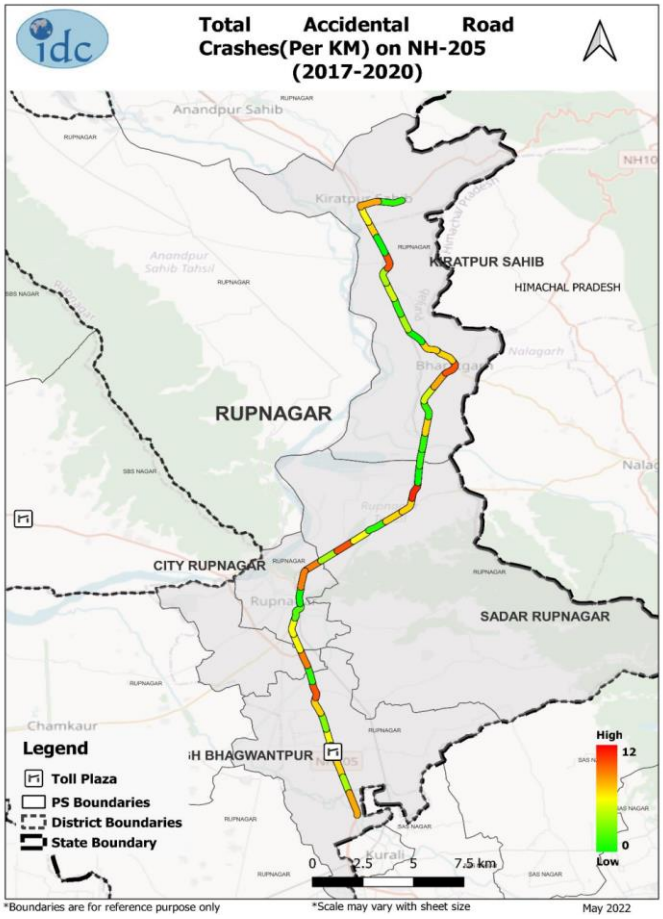

Fig. 7: Total Map Showing Total Road Accidents Per Km On NH-205.

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Conclusion:

This section of NH-205 has an average fatality rate per kilometre of 0.75 per year, while the national average for Indian national highways is 0.4 per year (MoRTH 2020). This means that the fatality rate on this stretch of NH-205 is twice as high as the national average, making it the most vulnerable and accident-prone overall.

In terms of precise data, there were 24 fatalities on NH-205 in 2020 out of 40 occurrences of traffic accidents, and 26 fatalities in 2019. When using the vehicle per km driven annually as an exposure component, however, the rate for the Behram Toll Plaza stays nearly same in 2020, at 0.032, even with the Corona shutdown. This indicates that, in comparison to other years, the likelihood of dying per million cars travelling on NH-205 has remained constant for the year 2020 and has not significantly decreased.

According to statistical research, none of the 11 unintentional blackspots that fell on this road in 2020 had a statistically significant improvement. overall for the Punjabi part of NH-205 Kurali – Kiratpur. The fifth chapter of this study makes suggestions for areas that still need improvement. Geographically speaking, the most vulnerable locations are the two first-order blackspots at Patalpuri Chowk and Heritage Haveli Cut, Solkhian, Major T-Point at Malikpur, and Kamal Sweets Shop, Bharatnagar. Every unintentional blackspot is an intersection.

References:

[1] Hamim O.F., Hoque M.S., McIlroy R.C., Plant K.L. and Stanton N.A. "A sociotechnical approach to accident analysis in a low-income setting: using Accimaps to guide road safety recommendations in Bangladesh" Safety. Science. 124, 104589 (2020), https://doi. org/10.1016/j.ssci.2019.104589.

[2] National Academy of Sciences, Highway Capacity Manual, Transportation Research Board, Washington, DC, 2010.

[3] Vogt A. and Bared J.G. "Accident prediction models for two-lane rural roads: Segments and intersections". Publication No. FHWA-RD-98-133, Federal Highway Administration, Washington, DC, 1988 https://doi.org/10.3141/1635-03.

[4] Mayora J. and Rubio R. "Relevant variables for crash-rate prediction on Spain's two lane rural roads". Presented at 82nd Annual Meeting of the Transportation Research Board, Washington, DC, (2003).

[5] Griffin L., Pendleton O. and Morris D. "An Evaluation of the Safety Consequences of Raising the Speed Limit on Texas Highways to 70 Miles per Hour". Texas Transportation Institute, Texas A and M University System, (1998).

[6] Garber N.J. and Ehrhart A.A. "Effect of speed, flow, and geometric characteristics on crash frequency for two-lane highways, Transportation Research Record: Journal of the Transportation Research Board, 1717, 76–83 (2000). https://doi. org/10.3141/1717-10.

[7] Harwood D.W., Bauer K.M., Richard K.R., Gilmore D.K., Graham J.L., Potts I.B., Torbic D.J. and Hauer E. "Methodology to Predict the Safety Performance of Urban and Suburban Arterials". Transportation Research Board of the National Academies, Washington, D. C, 2007. http://onlinepubs.trb.org/onlinepubs/archive/notesdocs/nchrp%20355(3)%20report.pdf.

[8] Kobelo D. Patrangenaru V. and Mussa R. "Safety analysis of Florida urban limited access highway with special focus on the influence of truck lane restriction policy". Journal of

Transportation Engineering 134 (7), 297–306, (2008). https://doi.org/10.1061/(ASCE)0733-947X(2008)134:7(297).
[9] Reddy G. V., Thakkar J. and Vargas F. "The effect of lane use restriction for trucks on traffic operations and safety". Enhancing Transportation Safety in the 21st Century, ITE International Conference, (1999).
[10] Ahangar A.N., Arghand E., Ahangar H.B. and Ganji S.S. "Recognizing the reasons of the accidents based on the rural drivers' mental patterns using Q analytical method". Safety Science. 125, 104649 (2020), https://doi.org/10.1016/j.ssci.2020.104649.
[11] Renski H., Khattak A. and Council F. "Effect of speed limit increases on crash injury severity: analysis of single-vehicle crashes on North Carolina interstate highways". Transportation. Research Record. 1665, 100-108 (1998). https://doi.org/10.3141/1665-14.
[12] Saha P., Roy N. and Basu S. "Influence of safety in performance assessment of two-lane highways: a critical review". Transportation Research Procedia. 44(6),) 35-39 (2020). https://doi.org/10. 1016/j.trpro.2020.02.006.
[13] Basu S and Saha P. "Regression model of highway traffic crashes: a review of recent research and future research needs, Proc. Eng. 187, 59-66 (2017), https://doi.org/10. 1016/j.proeng.2017.04.350.
[14] Llorca C., Moreno A.T., García A. and Pérez-Zuriaga A.M. "Daytime and night-time passing maneuvers on a two-lane rural road in Spain". Transportation Research Record. 2358, 3-11 (2013). https://doi.org/10.3141/2358-01.
[15] Khoury J.E. and Hobeika A.G. "Assessing the risk in the design of passing sight distances". Journal of Transportation Engineering. 133 (6), 370-377 (2007).
[16] Cheng-cheng T., Tie-jun Z. and Ling-tao W. "Safety impact on accesses in two-lane highways". Journal of Highway Transportation Research Development. 2 (2) 103-107 (2007), https://doi.org/10. 1061/JHTRCQ.0000205.
[17] Schneider W.H., Zimmerman K.H., Boxel D.V. and Vavilikolanu S. "Bayesian analysis of the effect of horizontal curvature on truck crashes using training and validation data sets". Transportation Research Reccord. 2096, 41-46 (2009). https://doi.org/10.3141/2096-06.
[18] Persaud B., Retting R.A. and Lyon C. "Guidelines for identifification of hazardous highway curves". Transportation Research Record. 1717, 14-18 (2000).